Andrew Myers Lyons – Curriculum Vitæ

Contact Information

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Research Interests

Combinatorial algorithms (especially algorithms on particular graph classes); complexity theory (especially algebraic complexity and lower bounds for monotone circuits); compiler tools for scientific computing (specifically algorithmic differentiation)

Education

Vanderbilt University, Nashville, Tennessee USA

B.S. in Computer Science, Mathematics — **August, 2001 - May, 2006**

Selected coursework: Abstract Algebra, Algorithms, Algorithms II (graduate level), Combinatorics, Compilers, Graph Algorithms (graduate level), Graph Theory, Lattice Theory, Linear Optimization, Nonlinear Optimization, Number Theory, Numerical Mathematics, Operating Systems, Programming Languages, Topology of Surfaces

Independent study: Data locality heuristics for Jacobian accumulation in automatic differentiation
Supervisor: Jeremy Spinrad

Employment

Mathematics and Computer Science Division, **Argonne National Laboratory**, Argonne, Illinois USA
Senior Software Developer, CSCAPES Institute — **October, 2008 - Present**

Computation Institute, **The University of Chicago**, Chicago, Illinois USA
Scientific Research Programmer — **August, 2007 - Present**

Advanced Computing Center for Research & Education (ACCRE), **Vanderbilt University**, Nashville, Tennessee USA
System Administrator — **May, 2006 - July, 2007**

Software & Tools for Computational Engineering (STCE), **RWTH Aachen University**, Aachen, Germany
Research Assistant — **June - December, 2005**

Mathematics and Computer Science Division, **Argonne National Laboratory**, Argonne, Illinois USA
Research Intern — **January - April, 2004**

Vanderbilt University Medical Center, Nashville, Tennessee USA
Research Intern — **May - August, 2004**

Department of Psychology, **Vanderbilt University**, Nashville, Tennessee USA
Research Assistant — **August - December, 2003**

Dartmouth-Hitchcock Medical Center, Hanover, New Hampshire USA
Research Assistant — **July - August, 2003**

Professional Activities

- Referee for **Optimization Methods and Software**
- Member, **SIAM**
- Editor, **Vanderbilt Undergraduate Research Journal** — **March, 2005 - May, 2006**

Publications

A. Lyons, "Acyclic and star colorings of joins of graphs and an algorithm for cographs". *Proceedings of the 8th Cologne-Twente Workshop on Graphs and Combinatorial Optimization (CTW09)*, pp. 199–202.

A. Lyons and J. Utke, "On the practical exploitation of scarsity[1]", *Proceedings of the 5th International Conference on Automatic Differentiation (AD08)*, Springer, Lecture Notes in Computational Science and Engineering 64, pp. 103–114.

H. Abdel-Khalik, P. Hovland, A. Lyons, J. Utke, and T. Stover, "A low rank approach to automatic differentiation," *Proceedings of the 5th International Conference on Automatic Differentiation (AD08)*, Springer, Lecture Notes in Computational Science and Engineering 64, pp. 55–65.

J. Utke, A. Lyons, and U. Naumann, "Efficient reversal of the intraprocedural flow of control in adjoint computations", *Journal of Systems and Software*, **79**(9):1280–1294 (2006).

U. Naumann, J. Utke, A. Lyons, and M. Fagan, "Control flow reversal for adjoint code generation", *Proceedings of the 4th IEEE International Workshop on Source Code Analysis and Manipulation (SCAM 2004)*, pp. 55–64.

Submitted for Publication

A. Lyons, I. Safro, and J. Utke "Randomized heuristics for exploiting Jacobian scarcity". Preprint ANL/MCS-P1716-0110, Mathematics and Computer Science Division, Argonne National Laboratory, January 2010.

A. Lyons, "Acyclic and star colorings of cographs". Preprint ANL/MCS-P1675-0909, Mathematics and Computer Science Division, Argonne National Laboratory, September 2009.

Preprints, Tech Reports, and Manuscripts (not appearing above)

A. Lyons, "Acyclic colorings and triangulations of weakly chordal graphs," Preprint ANL/MCS-P1701-1209, Mathematics and Computer Science Division, Argonne National Laboratory, December 2009.

A. Lyons, "Exact complexity results and polynomial time algorithms for derivative accumulation," Preprint ANL/MCS-P1700-1209, Mathematics and Computer Science Division, Argonne National Laboratory, December 2009.

A. Lyons, "Restricted coloring problems and forbidden induced subgraphs." Preprint ANL/MCS-P1611-0409, Mathematics and Computer Science Division, Argonne National Laboratory, April 2009.

E. Varnik, U. Naumann, and A. Lyons, "Toward low static memory Jacobian accumulation," Preprint AIB–2006–04, Institute for Scientific Computing, RWTH Aachen University, Aachen, Germany, 2006.

J. Utke, U. Naumann, and A. Lyons, "OpenAD/F: User Manual."

Poster Presentations

A. Lyons, "Exact Lower Bounds for Derivative Accumulation," *SIAM Workshop on Combinatorial Scientific Computing (CSC09)*, Monterey, California, October 2009.

A. Lyons, "Restricted Coloring Problems on Restricted Classes of Graphs," *Dagstuhl Workshop on Combinatorial Scientific Computing*, Saarbrücken, Germany, February 2009.

A. Lyons, "Structural Jacobian accumulation with unit edges," *The 5th International Conference on Automatic Differentiation (AD2008)*, Bonn, Germany, August, 2008.

[1] a combination of the words "scarcity" and "sparsity"

A. Lyons, "Exploiting algebraic dependences between local partial derivatives in Jacobian accumulation," *The 3rd International Workshop on Combinatorial Scientific Computing (CSC07)*, Costa Mesa, California, February, 2007. Abstract (pdf).

Conference and Workshop Presentations

* ***indicates speaker***

*****A. Lyons, "Acyclic and star colorings of joins of graphs and an algorithm for cographs," *Sparse Days 2009*, CERFACS, Toulouse, France, June 2009.

*****A. Lyons, "Acyclic and star colorings of joins of graphs and an algorithm for cographs," *The 8th Cologne-Twente Workshop on Graphs and Combinatorial Optimization (CTW09)*, Paris, France, June 2009.

*****A. Lyons and I. Safro, "Randomized Heuristics for Exploiting Jacobian Scarcity," *Dagstuhl Workshop on Combinatorial Scientific Computing*, Saarbrücken, Germany, February 2009.

*****A. Lyons, "Complexity of optimal accumulation of partial derivatives on dags," *The 47th Midwest Graph Theory Conference (MIGHTY XLVII)*, Chicago, Illinois, November, 2008.

*****A. Lyons and J. Utke, "Practical exploitation of scarsity," *The 5th International Conference on Automatic Differentiation (AD2008)*, Bonn, Germany, August, 2008.

*****A. Lyons, J. Utke, and P. D. Hovland, "Practical exploitation of scarsity," *SIAM Annual Meeting (AN08)*, San Diego, California USA, July, 2008.

I. Karlin, *****J. Utke, and A. Lyons, "Practical effects of local Jacobian preaccumulation," *The 3rd International Workshop on Combinatorial Scientific Computing (CSC07)*, Costa Mesa, California USA, February, 2007. Abstract (pdf).

*****E. Varnik, U. Naumann, and A. Lyons, "Fill-in and fill-out in Jacobian accumulation," *GAMM-SIAM Conference on Applied Linear Algebra*, Düsseldorf, Germany, July, 2006.

*****A. Lyons, "Trading fill-in for fill-out in sparse Gaussian-like elimination techniques on the extended Jacobian," *The 2nd European Workshop on Automatic Differentiation*, Shrivenham, Swindon UK, November, 2005.

*****A. Lyons and *****J. Utke, "Minimizing operation counts and maximizing data locality for efficient derivative codes in automatic differentiation," *The 2nd International Workshop on Combinatorial Scientific Computing (CSC05)*, CERFACS, Toulouse, France, June, 2005. Abstract (pdf).

Other Talks and Presentations

"Tight lower bounds on the complexity of derivative accumulation," Theory Seminar, Department of Computer Science, University of Chicago, Cicago, IL, March 9, 2010.

"Acyclic colorings of weakly chordal graphs," Graph Theory and Combinatorics Seminar, Department of Mathematics, Vanderbilt University, Nashville, Tennessee, November 30, 2009.

"New complexity results for Jacobian accumulation," LANS seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois, October 23, 2009.

"Acyclic and star colorings of joins of graphs and an algorithm for cographs," LANS seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois, May 20, 2009.

"Restricted coloring problems on restricted classes of graphs," LANS seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois, January 14, 2009.

"Optimal Jacobian Accumulation," TCS Open Problem Session, University of Chicago/TTI, Chicago,

IL, June 3, 2008.

"Jacobian accumulation with unit labeled edges," LANS seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois, April 2, 2008.

"Optimal derivative accumulation on series-parallel dags," LANS seminar, Mathematics and Computer Science Division, Argonne National Laboratory, Argonne, Illinois, September 19, 2007.

"An informal introduction to automatic differentiation," High Energy Physics brown bag lunch, Department of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee, April 23, 2007.

"The optimal Jacobian accumulation problem," Graph Theory and Combinatorics Seminar, Department of Mathematics, Vanderbilt University, Nashville, Tennessee, March 14, 2007.

Guest lecture on automatic differentiation in optimization, MATH 287: Nonlinear Optimization, Department of Mathematics, Vanderbilt University, Nashville, Tennessee, February 23, 2006.

"Gaussian-like elimination on the extended Jacobian matrix," Graph Theory and Combinatorics Seminar, Department of Mathematics, Vanderbilt University, Nashville, Tennessee, November 7, 2005.

"Combinatorial problems in automatic differentiation," Graph Theory and Combinatorics Seminar, Department of Mathematics, Vanderbilt University, Nashville, Tennessee, April 18, 2005.

Skills

- Operating Systems: GNU/Linux, Unix, Mac OS X, Windows.
- Languages: Fortran, C/C++, Java, Python, Perl, Lisp, SQL, Unix shell scripts.
- Revision Control Systems: SVN, mercurial, CVS, Bitkeeper.
- Applications: LaTeX, Graphviz, Gnuplot, Mathematica, Matlab, Bison, Flex, RRDtool, Nagios.

References

Available upon request